Collisional Cooling of Negative Ion Beams

Y. Liu, J. F. Liang, G. D. Alton, J. R. Beene
Oak Ridge National laboratory
P. O. Box 2008, Oak Ridge, TN 37831, USA

H. Wollnik and Z. Zhen
Justus-Liebig-Universitat, 35392 Giessen, Germany

ABSTRACT

The Holifield Radioactive Ion Beam Facility (HRIBF) uses the Isotope Separator On-Line (ISOL) technique to provide accelerated radioactive ion beams (RIBs) for nuclear structure physics and nuclear astrophysics research. The secondary radioactive ion beams, produced by this method, are often mixed with isobaric contaminants that compromise experimental results. These contaminant beams must either be eliminated or reduced to a tolerable level. Since the HRIBF utilizes conventional magnetic mass separation to deal with this problem, adequate isobar separation can only be effected with very high quality RIBs. Beam qualities from conventional RIB sources are often inadequate for this purpose. We have investigated the feasibility of using collisional cooling by injecting low-energy negative ion beams into a gas-filled RF quadrupole ion guide where ion energies can be dissipated through collisions with a buffer gas. The objective of the present studies was to develop a system and evaluate its feasibility for cooling negative ion beams to achieve beam qualities required for eliminating contaminant isobars through magnetic analysis without sacrificing intensity. A detailed description of the collisional cooler, energy analysis system and results derived from cooling experiments with both negative and positive ion beams will be given in this presentation.